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This report provides an initial investigation of standards needed to support development of the STARS components. The report contains a standards profile which classifies standards by functional domains and which serves as the basis for assessing standards maturity and degree of attention needed by STARS. Relevant standards are partitioned into three tiers:

- o standards that require immediate development work
- o standards that require active monitoring
- o standards that can be addressed by passive monitoring

The report also provides a detailed account of the data and analyses used to derived the initial list and plans.

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STARS Q14 INTERFACE STANDARDS

PRIORITIZED LIST AND INITIAL PLANS

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PREFACE

This document was produced by Unisys Corporation, Defense Systems, in support of the Unisys STARS Prime contract. This CDRL is for the Interface Standards Task, Q14, of the Unisys STARS First Increment. It is CDRL type A005 number 00500 for the Prioritized List and Initial Plans.

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1 Executive Summary

This report is the result of the Q14 task Q14001 "Prioritized Standards List", and corresponds to CDRL A005 "Informal Technical Data."

This report provides a prioritized list of standards needed to support the development of STARS components. Prior to specifying the standards prioritization scheme, the STARS standards profile, shown in Table 2, was defined. This profile classifies standards by functional domains, and serves as the basis for the prioritized list by identifying the standards important to achieving STARS objectives. In this report the Q14 task is called the the Interface Standards task and Q14 personnel are referred to as the Interface Standards team.

The prioritized standards list is partitioned into three tiers: those standards that require immediate development work, standards that require active monitoring, and standards that can be addressed by passive monitoring. Table 4 on page 17 summarizes the prioritized list and actions for each standard in the list. Section 8 provides more detailed descriptions of the recommended actions.

For each standard in the immediate development tier, a high-level description of the first increment plan of action is provided. These actions are scoped to accommodate various constraints, such as maturity of the standard or robustness of rehosted implementations. Regardless of the scope of the plan of action, the goal is always the earliest possible availability of standard virtual interfaces and implementations for STARS.

Also provided in this report is a detailed account of the data and analysis used to derive the prioritized list and plans. Since STARS involvement in standardization activities will be required for the duration of the STARS development tasks, the *process* of deriving prioritized lists and plans needs to be repeatable and refinable. The Interface Standards task process model for standards selection and prioritization is summarized in Figure 1 on page 8. Sections 4-7 describe key aspects of the process.

It is important to note that the process used to generate the prioritized list is continuous. It is expected that the STARS standards profile will evolve as critical inputs to the process, e.g., portability studies, industry and DoD initiatives, and STARS requirements, are monitored. Thus, the STARS profile described in this report is a snapshot of current STARS requirements and industry consensus on standards needed to support true application portability. Comments concerning the STARS profile and prioritized list are encouraged.

2 Introduction

This report is the result of the Interface Standards task Q14001 "Prioritized Standards List," and corresponds to CDRL A005 "Informal Technical Data." This report serves several purposes. It provides:

1. Overall scope and objectives of the Interface Standards task
2. Detailed description of the standards selection and evaluation process

3. Identification and prioritization of STARS virtual interface standards
4. High-level description of first-increment Interface Standards tasks
5. Background report on important related activities

This report assumes the reader is familiar with the standardization process. No attempt has been made to define every term before use; a however, glossary of terminology and acronyms is included at the end of this report.

3 Scope and Objectives

The Interface Standards task is the instrument by which standard virtual interfaces are migrated from the standards community for use by STARS developers and other application developers. The scope of this task encompasses all standards pertinent to achieving long range STARS objectives, regardless of whether their implementations are being provided under other STARS tasks.

To achieve this objective, long- and short-term goals must be balanced. For the long term, activities necessary to anticipate critical standards and to position STARS to have influence on these standards are emphasized. For the short term, activities needed for the delivery of Ada implementations of existing standards are emphasized. Neither the standards world nor STARS stand still; both will evolve and change over time. Thus, as new standards emerge, and as the STARS program evolves, long- and short-term objectives may be modified. The Interface Standards effort must meet the need for planning in a dynamic environment, and must anticipate and account for changing capabilities and requirements.

Our approach to maintaining this balance is to establish a process to ensure the continuous gauging and refinement of long- and short-term plans and activities necessary to pursue STARS interests. This standards selection process, illustrated in Figure 1, provides an evolving "hit list" of critical standards, and an evaluation of the anticipated time when the standard will be needed. Key aspects of this process are:

- Continuous, active monitoring of important industry standards activities related to construction of open systems architectures
- Development and continuous refinement of reference models for evaluating existing and emerging standards against STARS needs

Once critical standards are identified, development plans must be established which eventually make available the standard virtual interfaces and implementations for STARS use. The Interface Standards team takes the technical lead on standards vital to STARS that are not being developed by other funded tasks. This aggressive technical development aspect is crucial to ensure that important standards are developed so they may be available within the STARS Repository before the need for the interfaces arise.

In some cases, taking the technical lead implies no more than rehosting existing implementations. In other cases, more significant development activities will be required. For example, enhancements to partial standards implementations may be required, or ground-breaking activities may be necessary to support later development. In all cases, if virtual interfaces are candidates for standardization, the Interface Standards team will, in addition to its role as standards integrator, pursue formal standardization by the most appropriate means.

A prioritized list of standards and the plans to pursue these standards during the first increment is provided. Support for early STARS usage has been emphasized, and will form the core of the technical development efforts. In addition a detailed description of the process model and criteria used to develop these plans has been documented here. The final report will re-document the planning process, reflecting its evolution throughout the course of the first increment.

4 Approach

The Interface Standards task is based on the premise that the set of standards of interest to STARS will evolve over time. There is a growing trend in the standards community to anticipate emerging trends and technologies. Thus new and potentially important standards may appear which might influence STARS development efforts. Also, since the STARS development process is *evolutionary*, different standards may assume more or less criticality, depending on where we are in the STARS development. Thus, new standards may be identified and priorities among standards may shift as technology progresses and provides new opportunities for virtual interface standards, as lessons-learned during STARS development emerge, and as the development of STARS components progresses.

The identification of relevant standards, and the approach taken for migrating these standards into STARS use, are separate tasks and require different approaches. For purposes of standards identification, the Interface Standards team has taken a standards reference model and application portability profile approach. For purposes of plan generation, an attribute-driven approach is employed.

Reference Model and Portability Profile Approach. To a large extent, which standards are pursued on behalf of the STARS program is dependent on an understanding of STARS needs, i.e., which functional areas are important to address (e.g., operating systems, database, graphics), and within these functional areas which standards are relevant. The latter issue is complicated by the sometimes subtle relationships between standards within a functional area, such as competing standards or standards with overlapping functionality. Reference models and portability profiles provide a framework for identifying and interrelating standards of interest to STARS.

Attribute Approach. There are a variety of means of pursuing standards, and these plans of pursuit depend on a number of factors, including: maturity of the standard, available influence in the standardization effort, and timing constraints such as relevance of the standard to STARS short- and long-term objectives. Such factors are quantified as attributes which are used in a trade-off evaluation to determine the appropriate course of action for pursuing important standards.

Figure 1 provides a process-model overview of the relationships between portability studies and standards attributes. As shown in the figure, the first major output is the *STARS Profile*. This profile is provided in Table 2. It is the result of the assimilation of information concerning portability studies, DoD initiatives, and the STARS Architect's strategic plans. The STARS profile, STARS tactical planning, and the attribute study provide input into the *evaluation* phase. The attribute study is described in Section 5 and summarized in Table 3. The output of this evaluation is the ***Prioritized List*** which is shown in Table 4 within Section 6. The evaluation itself and the details of the Development Tasks are presented in Section 7.

4.1 Reference Models and Portability Studies

One goal of STARS is the creation of applications based upon a set of interlocking, cooperating standard virtual interfaces. Unfortunately, the emergence of this goal was preceded by an explosive and uncoordinated emergence of standards. These standards were developed as application needs were recognized, and often were based upon proprietary systems and solutions. In short, the existing set of standards defined for information systems is far from interlocking: in addition to holes in needed functionality, standards are often duplicative if not outright competing.

Recognition of software application portability and the need for a cohesive set of standards to support portability is widespread; STARS is just one of many programs pursuing this objective. One of the most important standardization activities underway now in industry, as well as in the formal standards world, is the development of reference models and standards profiles; these models and profiles are being created for the purpose of identifying and relating standards which are required to achieve application portability within various application domains.

The standards profiles and reference models being developed now are directly related to STARS objectives, and served (and will continue to serve) as crucial input into the standards selection process. The STARS standards profile is based on this related work and then adds to it the Ada specific and language-independent standards work which are of particular importance for early emergence of STARS components.

4.2 Attribute Study

A great many variables exist which affect the manner in which standards ought to be pursued. These variables can and should be identified so that alternative plans of action can be compared and evaluated; we represent these variables as attributes. The intent is not so much to make plan evaluation and generation a deterministic process as it is to provide a measurable rationale for choosing one plan over another. The standards attributes which have been identified are: process, stage, family, relationship, sponsor, completion, domain maturity, standard maturity, availability, STARS relevance, existing formal and informal involvement with the standard, and relative influence on the standardization process. The Attribute Study section explains these terms, and the possible values of each of these attributes are shown in Table 3.

4.3 Attribute Evaluation and Trade-Off Study

Given an initial STARS standards profile and a generic attribute schema to characterize standards, the next step is evaluation of the attributes for each standard within the STARS profile. The result of this evaluation and analysis is a set of recommended actions for each standard.

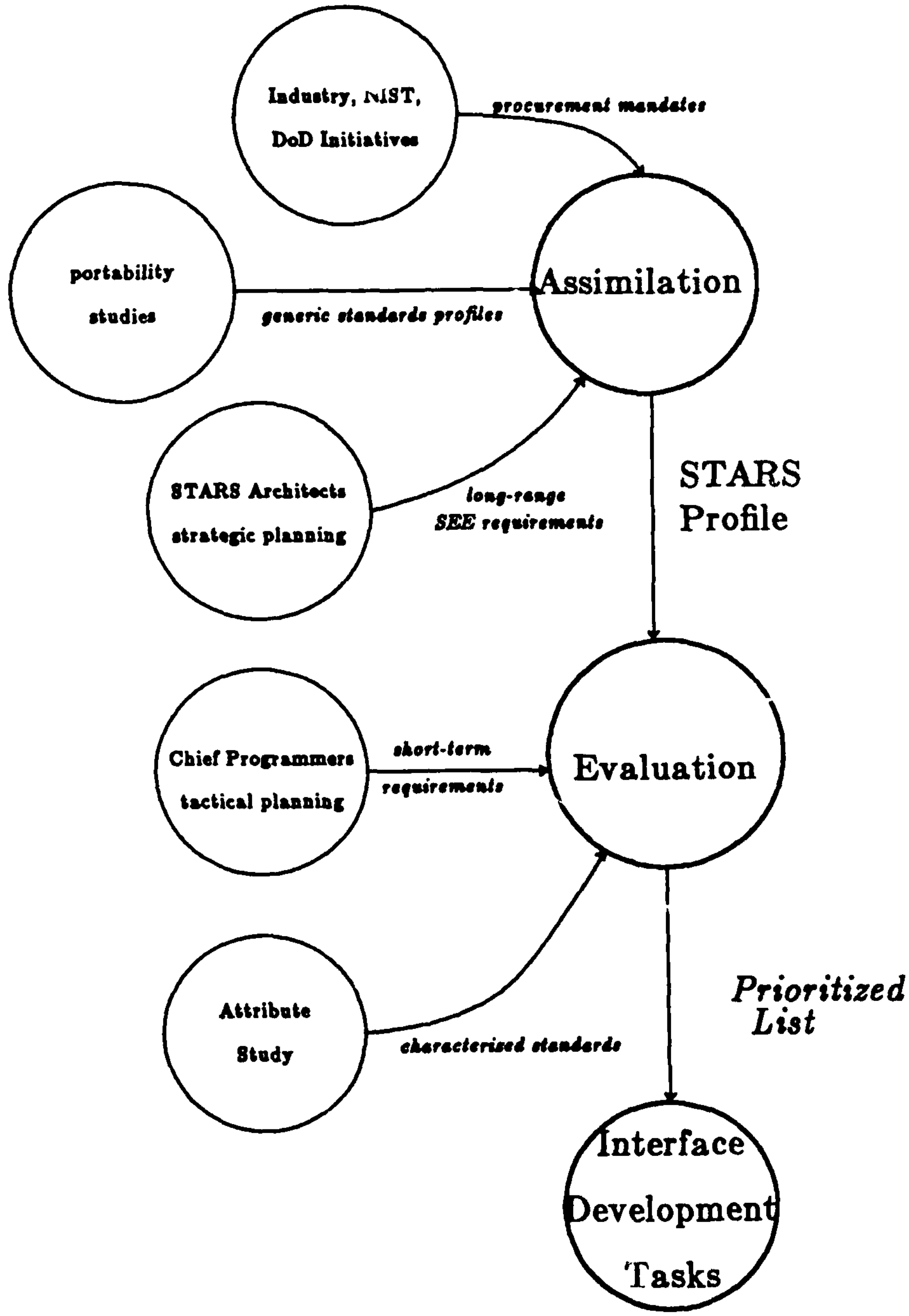

Figure 1: Q14 Analysis Process Model

Attributes compete in the evaluation criteria. For example, a standard which is needed for applications would have lower priority than a standard used for framework or tools. On the other hand, if the same standard has available Ada bindings or implementations, the low level of effort required to make an implementation available in the STARS Repository may weigh in favor of early action. The trade-off analysis is the process of considering the interaction between the various attributes of a standard and deciding what the appropriate action is.

It is important to note that although the trade-off analysis has produced the prioritized list of activities which is shown in Table 4, assignment of priorities does not imply that one standard is more or less important than another. For instance, it is meaningless to assert that CAIS-A is more or less important than POSIX or the X Window System. Rather, the ordering reflects the most cost-effective use of first increment resources to achieve short- and long-term STARS objectives.

5 Reference Models and Standards Profiles

Within the standards community profiles and reference models are being developed which are directly related to STARS objectives. Two appendices provide background information on this work:

- **Appendix A, Application Portability Studies** is a report describing new work on application portability that has been undertaken within several standards organizations during 1988.
- **Appendix B, Glossary of Terms** provides definitions and also project assignments of selected standards committees.

Background information on standards organizations can be found in [Cuthbert 87,JTC188 ,X3SD1 88, X3SD2 85,X3SD4 87]. Document references are not included in the bibliography, instead the numbers of standards and of committee documents are simply noted within the body of this paper.

This section presents important terminology, tells why the studies reported in Appendix A are of significance to STARS SEE, presents the NIST Application Portability Profile, and concludes with the STARS Standards Profile – Version #1.

5.1 Standards Terminology

These definitions prepare for the following section which discusses current studies on application portability.

JTC 1 - Joint Technical Committee #1 (JTC 1). "JTC 1" will appear in this document where the reader may expect to see "ISO." The ISO/IEC Joint Technical Committee 1 (JTC 1) on Information Technology was established in 1987 by the two principle international standards organizations, the Organization for International Standardization (ISO) and the International Electrotechnical Commission (IEC).

NIST - National Institute of Standards and Technology, formerly NBS. The National Bureau of Standards was renamed to NIST on August 23, 1988.

NIST APP - NIST Application Portability Profile. This profile was a starting point for the POSIX Guide work and is included as an appendix to the federal version of the POSIX standard, FIPS 151.

POSIX - Portable Software System Interface - POSIX and its related standards are developed by IEEE P1003 and JTC 1 SC21 WG 15.

POSIX Guide - The project of IEEE P1003.0: Guide to a POSIX-based Open Systems Architecture.

TSG-1 - JTC 1 Technical Study Group #1. The first technical study undertaken since the formation of JTC 1. Formally referred to as the JTC 1 Special Working Group on Strategic Planning Application Portability Study Group (JTC1 SWG/SP-APSG).

TAG/APSG Used to refer to the United States JTC1 Technical Advisory Group - Application Portability Study Group – the TAG for TSG-1.

X3/SPARC/APSG - The ANSI X3/SPARC Application Portability Study Group. A study on application portability undertaken by the X3 Standards Planning and Requirements Committee (SPARC).

5.2 Studies on Application Portability

Standards requirements of architectures such as the STARS SEE rely heavily upon guides, profiles and reference models from various standards organizations. Guides and profiles may specify sets of standards to achieve an open systems environment, whereas reference models provide a framework from which standards may be derived. The National Institute of Standards and Technology Application Portability Profile (NIST APP) described in Table 1, is the basis for the STARS profile described in Table 2. The NIST APP was evaluated in terms relevant to STARS requirements including applicability to Ada environments.

Several standards organizations have undertaken studies of application portability during 1988. Appendix A gives a detailed report on the status of the work of these groups. Their progress will continue to be actively monitored and appropriate features of their reference models or profiles will be adopted.

The POSIX P1003.0 committee is developing a Guide to POSIX Based Open System Architecture. At the initial meeting of the POSIX Guide group in March, 1988, there was an examination of the NIST APP. Because of this common root and from information derived from reading all of the P1003.0 documents, the STARS profile is already incorporating ideas from the POSIX guide.

The JTC 1 has established an Application Portability Study Group under the aegis of its Special Working Group on Strategic Planning. This study group is known as Technical Study Group #1 (TSG-1). The first meeting of TSG-1 occurred in October, 1988. Inferences concerning the direction the group will take can be made on the basis of documents leading up to that meeting. The United States position is that the central task of the TSG-1 should be the development of a framework, or model, specifically a *Functional Interface Model.* The recommendation is that the work should begin with a review of the current work, including the POSIX Guide, the X/OPEN Portability Guide, and the Open Software Foundation (OSF) Application Environment. Then, a comparison of current JTC 1 work with the model will permit the identification of relevant standards which currently exist or are under development in JTC 1. The comparison would identify any possible functional overlap and could yield recommendations for new work and/or the need for some reorganization of JTC 1 in order to effectively address standards requirements for application portability (JT/88-396-AP). Another recommendation, from the ANSI X3/SPARC/APSG, is that subtasks for TSG-1 be organized based on functional profiles for various application envircnments, such as: office, commercial, scientific, real time, industrial automation, etc (ANSC APSG/88-016).

Profiles mandated by the U.S. government place further requirements the STARS profile. The two most prominent ones are the Government OSI Profile (GOSIP) which mandates that network applications use a specific OSI subset in all government procurements by 1990. The other, the Computer Aided Acquisition and Logistics Support (CALS) mandates the use of certain data interchange standards in future government procurements. These mandates must be accommodated in the STARS profile.

The STARS standards profile in Table 2 reflects the synthesis of profiles applicable to STARS and anticipated application domains. We expect the STARS profile to evolve as the emerging profiles and/or reference models from the POSIX Guide group and TSG-1 mature, and as new application domains and STARS tools are defined.

6 Attribute Study

A number of attributes must be considered when developing a broad strategy for identifying and pursuing candidate standards for insertion into STARS. Many of these attributes, such as life-cycle stage, are derived from the underlying standardization process. STARS recognizes, as evidenced by the RFP SOW for Q14, that standards undergo a lifecycle, and that different activities must be undertaken to pursue standards depending upon which lifecycle phase applies. Part of the analysis phase of the Interface Standards task was to identify the most critical attributes pertaining to the standardization process; these attributes are discussed in this section.

Another, orthogonal, set of attributes which affect the standards selection process stem from STARS requirements. Ideally, the standards available for insertion into the STARS repository would be well-defined and developed (in Ada), non-overlapping, and tightly inter-locked. However, domain coverage of available Ada-implemented standards is uneven; further, as noted earlier in this report, the real world of standards provides anything but non-overlapping interlocking standard virtual interfaces. For this reason, several factors must be weighed, including: 1) anticipated impact of a standard on STARS development, 2) identification of standards which have Ada interface definitions and/or Ada implementations, and 3) anticipated time when standards will be most needed by STARS applications (including the STARS SEE).

Table 3 summarizes the attributes used for the initial standards attribute analysis. The remainder of the section provides more detail on the significance of these attributes.

Process – The Process attribute has two possible values: consensus and de facto. A de facto industry standard, such as the X Window System, may eventually migrate into the formal consensus

Function	Element	Interface Specification
Operating System	Extended POSIX	IEEE P1003.1 + Extension
Database Management	SQL	FIPS 127
	IRDS	X3.138 (proposed FIPS)
Data Interchange		
- Graphics	CGM	FIPS 128
- Product Data	IGES, PDES	NBSIR 88-3813
- Document Processing	SGML	ISO 8879-1986
	ODA/ODIF	ISO/DIS 8613
Network Services		
- Data Communications	OSI	GOSIP
- File Management	NFS	IEEE P1003.net
User Interface	X Window System	X3H3.6
Programming Services	C	X3J11, draft X3.159
	COBOL	FIPS 021-2
	Fortran	FIPS 119
	Ada	FIPS 119
	Pascal	FIPS 109

Table 1: NIST Application Portability Profile

Function (Category)	Element	Specification
Operating System	CAIS-A	(Proposed) DOD-STD-1838A
	POSIX	FIPS 151
	Extended POSIX	IEEE 1003 extensions
	POSIX/Ada	IEEE 1003.5
Database Management	SQL	FIPS 127
	SQL/Ada	competing specifications
	IRDS	X3-138-1988
	IRDS/Ada	informal
User Interface	X Window System	X3H3.6/88-28R2
	X/Ada	X3H3.6; X3H3.4
Network Services	OSI	FIPS 146 (GOSIP)
	OSI/Ada	informal
	TCP/IP	MIL-STD-1778, MIL-STD-1779
Graphics	GKS	FIPS 120
	GKS/Ada	FIPS 120
	PHIGS	FIPS 153
	PHIGS/Ada	ISO DIS 9593-3
	GKS-3D	ISO 8805
	GKS-3D/Ada	JTC1/SC24 WD N189
	CGI	ISO DP 9639
	CGM	FIPS 128 (CALS)
Language Specific	Diana	informal
	ADL	STARS RFP
	ARTEWG	SIGAda working group
	Ada9x	JTC1/SC22 WG9
Data Interchange	SGML	MIL-M 28001 (CALS)
	IGES	MIL-D 28000 (CALS)
	PDES	consortium (potential CALS)
	ASN.1	IS 8824
	Procedure Calls	JTC1/SC22 WG11 N57
	Datatypes	X3T2/87-121
Language Independence	Guidelines for Language Bindings	JTC1/SC22 N466

Table 2: STARS Standards Profile

Attribute	Values
Process	*de facto*,consensus
Stage	proposal, reference model, development, approved, (implementations/bindings, (ada, non-ada)), maintenance, revision, reaffirmation, specification, informal standardization(consortiums), obsolete
Family	data base, graphics, user interface, data interchange, networking, operating system, distributed processing
Relationship	(standard,(competing,overlaps, subset, enabling, complimentary))
Sponsor	ISO, X3/ANSI, IEEE, ANSI, FIPS, MIL-STD, informal/*de facto*, CALS, MAP/TOP, X/OPEN
Completion	year
Domain Maturity	low, medium, high
Standard Maturity	low, medium, high
Availability	Commercial, ((Public Domain, Purchase) Prototype)
SEE Relevance	((tools, framework, applications), (Low, Med, High))
Current Involvement	STARS, Unisys Defense Systems, Unisys commercial, none
Influence	none, low, medium, high

Table 3: Standards Attributes

process. Once a de facto standard is well established, conformance to functionality provided by existing implementations is of overriding importance. In the development of consensus standards which are new (not migrating de facto standards), the weight of good ideas and hard requirements may assert themselves upon the formalization of the standard. The Process attribute is important for planning purposes since different activities are appropriate for de facto standards than are appropriate for more formal consensus standards. Great emphasis will be placed on making STARS-developed Ada bindings de facto industry standards; simultaneously there must be participation on language binding committees. This dual route is the strategy for STARS influence and eventual migration of the de facto Ada binding standards to more formal consensus standards.

Stage – This characterizes the position of a standard within a life-cycle model. For both consensus and de facto standards processes, there are discrete phases which standards pass through before reaching ultimate maturity within the process. The amount of influence, and the kind of influence and expertise needed (i.e., domain, Ada, or both) depends upon the life cycle phase.

Family – Family characterizes the standard by where it fits into the STARS standards profile. In some cases the lattice effect places a standard under multiple families. These cases are important to note, since inter-family standards relationships may indicate where standards need to cooperate, and hence where additional virtual interfaces are required. For example, GKS is related to the graphics and data interchange families and the X Window System is related to graphics and user-interfaces. The intersection of these systems in the graphics family implies the need to develop a strategy for X and GKS to act cooperatively within a workstation environment.

Relationships – Besides the inter-family relationships described above, intra-family relationships are also important. For example, it is important to know where distinct standards are *competing*, so that an informed decision can be made to choose either or both standards for insertion into the STARS repository. Other relationships, e.g., overlaps, subset, complimentary, etc., need to be made explicit so that cooperating standards can be developed and incorporated by STARS in an appropriate order.

Sponsor – It is important to know the backers of a standard, regardless of whether the standard is consensus or de facto. When competing standards are being developed by two bodies, some notion of authority must be factored in. ANSI standards are sometimes not identical to corresponding ISO standards. Suppose the ANSI standardization of X varies from the well established de facto standard? Also, sponsorship may come from DoD and industry initiatives (e.g., GOSIP, CALS, X/OPEN). Identifying interest-group interactions is important.

Completion – Completion date provides a timeline reference for gauging standard maturity and life-cycle phase. For example, a standard recently formalized is likely to be stable for several years (until the mandatory reaffirmation).

Domain and Standard Maturity – Domain maturity corresponds to the stability of the technology underlying the standard. The growing tendency within ANSI and ISO/IEC/JTC1 towards developing anticipatory standards means that standards are emerging for relatively immature functional areas; in such areas, the life cycle for a standard may be compressed as technology within the domain progresses.

Standard maturity describes the level of frequency of modifications and revisions the standard is undergoing to keep abreast of changing requirements and technology.

Availability – Availability is a singularly important attribute. There are two types of availability: Ada interface definitions (bindings) and Ada implementations. Both bindings and implementations are important and they don't necessarily go together. An Ada interface definition can exist with or without an implementation of that binding; GKS has a definition and an implementation, PHIGS has an interface definition but no implementation. On the other hand an implementation of a standard can exist without an interface definition; SGML is the example. Even though our primary objective is providing standard virtual interfaces for STARS, the existence of an Ada standard implementation of acceptable quality may outweigh other attributes in deciding to rehost a standard for STARS.

SEE Relevance – The values of the Relevance attribute correspond to three classes of interface users: the SEE framework, SEE tools, and applications. The framework makes use of operating system services, and other baseline system facilities (e.g., X-Window). Tools require interfaces to support the development of SEE applications, e.g., testing tools, management tools, formal methods tools, etc. Applications pertain to interfaces used by end-user applications developed with SEE services and tools.

These three classes of interface users provide a crude timeline, and thus a measure of imperativeness. Interfaces required by the framework and baseline being most critical in early increments; those required by tools most critical in early and middle increments; and those needed by applications most critical in middle to late increments.

Current Involvement – This indicates what organizations within Unisys and STARS are actively involved within particular standards efforts. The Interface Standards task needs to be aware of the key players within a standard; available expertise and influence needs to be identified and exploited to ensure maximum input of STARS views and requirements into the standards process.

The existence of STARS activities within a standard area, as well as activities of the cooperating Primes, must be made known for obvious reasons.

Influence – If the goal of participation in standardization activities is influence on the emerging standard (as opposed to other reasonable goals, such as acquisition of expertise and monitoring of the emerging consensus), cost effective active participation demands a reasonable amount of concrete influence. Unfortunately, such power is not always available. Newcomers to standards within a mature domain, such as database systems, are likely to be confronted by an existing network of influence. On the other hand, even within stable domains, opportunities for increased influence are available if the newcomer brings something concrete and unique to the table, such as an Ada implementation and a proposed standard virtual interface.

An understanding of the limitations, and potential, for acquiring influence in formal standards is necessary for planning purposes.

7 Prioritized Standards and Generic Plans

Table 4 provides the STARS *Prioritized List* annotated with the actions to be taken by the Interface Standards team during the first increment. The prioritized list represents a partial ordering; three (3) priority levels are identified. The "top" tier identifies standards development tasks; the middle tier identifies standards which are not vital for first increment development, and working/study groups that should be actively monitored. The bottom tier require no immediate action, but STARS should be kept aware of developments (passive monitor).

The balance of the section describes the terminology used in Table 4 (e.g., "active monitor", "propose") These descriptions will put into context the actions taken for standards designated in the prioritized list.

As noted earlier, the Interface Standards team will take the technical lead where important standards are identified but are not under development by STARS (or elsewhere). The activities undertaken as technical lead can be categorized as *development* tasks. Development tasks span early ground-breaking efforts to rehosting and tuning of stable Ada implementations. The key goal for the first increment is more focused on providing a critical mass of virtual interface functionality for STARS SEE development; issues of underlying implementation language are secondary. For example, the X toolkit level interfaces are critically important for tool development; such interfaces will be required by tool builders whether or not a full-blown Ada implementation of X (protocol layer and toolkit layer) is immediately available.

The kinds of standards development tasks undertaken in the first increment are outlined below; these task denotations are referenced as Standards Interface actions in later sections. The task definitions are presented in alphabetic order for ease of reference.

Standard	Actions
	First Tier
CAIS-A	participate, rehost, evaluate, propose (Lead – Task Q8)
POSIX	participate, propose, white paper
DIANA	port, evaluate, rehost, application, propose, working group
X/Ada	participate, port, evaluate, application, propose, white paper
IRDS/Ada	participate, evaluate, analysis, propose, white paper
OSI/Ada	active monitor, participate, white paper
TCP-IP/Ada	rehost, application (Lead – Task Q8; Sub, CSC)
GKS/Ada	rehost, application (Lead – Task Q14; Sub, STI)
SQL/Ada	participate, active monitor
	Second Tier
SGML	evaluate (Lead – Task Q13)
TSG-1	active monitor
CALS	active monitor
Guidelines for –	
– Language Bindings	active monitor
CGM, CGI	active monitor (Q14 Sub, STI)
PHIGS/Ada	active monitor, standardize
	Third Tier
GKS-3D	passive monitor
ASN.1	passive monitor
IGES	passive monitor
PDES	passive monitor
Procedure Calls	passive monitor
Data types	passive monitor

Table 4: STARS Prioritized List

Active Monitor. Active monitoring means that the Interface Standards team will read the documents of a standards committee and, if appropriate, provide input to the committee representative(s). Appendix A is based on active monitoring of a number of committees which are engaged in application portability studies.

Analysis. Analysis refers to "groundwork" activities. If a requirement for virtual interfaces is identified with no current implementation available, preliminary investigation is called for. The goal of the investigation is to bound the level of effort to provide the interface, and identify technical approaches to pursuing development of the interfaces.

Application. Application drivers will be developed to demonstrate virtual interfaces prototyped and/or rehosted for STARS. Application drivers provide a vehicle for iterative refinement of Ada bindings implementations, and can provide a subjective measurement of the quality of proposed Ada bindings. Where a ported application is being evaluated, other styles of application driver, e.g., conventional test suite, may be developed instead.

Evaluate. Evaluation of existing work, either in Ada or other languages, provides invaluable input to identifying an approach for rehosting an implementation for STARS. Evaluation will determine if an existing implementation is suitable as a basis for further development, and will identify trade-offs among competing implementations and approaches.

Implementors Working Groups. For prototype or emerging standards implementations, implementors working groups provide valuable hands-on experience and feedback to the standardization process. Communication will be by electronic mail, where possible. First increment working groups will be formed initially around STARS Prime contractors and subcontractors, but will not restrict participation of other persons from industry/academia.

Initiate. This refers to "start-up" activities, such as lobbying for creation of formal working groups or subcommittees. Less formal activities, such as creation of industry mailing lists and provision of interface implementations into the public domain, are also possible.

Participate. This refers to active participation on formal committees. While in general standards participation should be viewed as an avenue for achieving formal status for Ada virtual interfaces, direct participation in standards committees and working groups not focused on Ada issues may be necessary to represent STARS interests on a more strategic plane (e.g., POSIX IEEE 1003.0).

Passive Monitor. Passive monitoring means reading trip reports or other information about a standards group which is forwarded to the Interface Standards team by Unisys or STARS personnel. Close contact with independent Unisys Ada Initiative and Unisys Corporate Standards activities, as well as with the other Primes and subcontractors, will help ensure that STARS is informed of important developments.

Port. A first step of detailed analysis may be porting of existing systems. Porting an implementation does not imply rehosting (i.e., tight integration) to the STARS SEE. Systems not written in Ada may be ported as a starting point for virtual interface development e.g., an Ada veneer interface to existing non-Ada implementations.

Propose. This refers to attempts to migrate a given set of interfaces to more formal standardization. Where a standing committee exists, Ada interfaces will be formally proposed (e.g., X3H6

X Window System). Where no committee exists, the interface will be promulgated through working groups, Prime repositories, and "public domain" repositories in an effort to achieve de facto standardization.

Prototype. Prototyping activities are appropriate where preliminary virtual interfaces are defined. Application drivers and implementors working groups provide empirical feedback needed to refine the prototype interfaces. Prototyping is the first step towards attempting to create de facto standards.

Rehost. If an implementation is evaluated favorably, it will be rehosted to the baseline STARS SEE. Although rehosting implies tight integration with the framework (i.e., CAIS-A, POSIX), Ada veneer interfaces (e.g., X Window System) may be rehosted as an intermediate step to integration.

White Paper. Sometimes fundamental issues need to be raised and addressed prior to embarking on potentially costly development efforts. In cases where such fundamental development tasks need undertaking, the results of the necessary early analysis will be presented as white papers. The goal of white papers is to provide a motivated and well researched starting point for further action, and to encourage early dialog among interested parties and domain experts.

8 Detailed Analysis and Proposed Actions

This section provides a high-level description of the activities to be undertaken by the Interface Standards team in the first increment.

All of the standards included in the STARS standards profile shown in Table 2 are considered important to the STARS program. While the trade-off analyses described in this section have produced the prioritized list of activities which is shown in Table 4, the assignment of priorities does not imply that one standard is more or less important than another. For instance, it is meaningless to assert that CAIS-A is more or less important than POSIX or the X Window System. However, it is possible to assign priorities to these standards by identifying those virtual interfaces which will have the most early impact on the emerging STARS SEE. Further, it is possible to identify standards not sufficiently mature to support upcoming demands and therefore require fundamental work. The first increment priorities and actions result from the trade-off analysis described in this section.

Each of the standards in the first tier is being pursued during the first increment and is discussed in this section (with the exception of CAIS-A and TCP-IP, which are being developed by Q8). For each standard the trade-off analysis is followed by the statement of actions. The analysis of each standard, based on its attributes describes its relevance to STARS, and the rationale for undertaking activities on behalf of the standard in the first increment. The action section describes the goals and tasks to be accomplished during the first increment. The scope of these tasks is aggressive, and is based upon the (untested) assumption that the quality of rehosted work is sufficiently high to serve as a platform for further development. Should this assumption prove false, some readjustment of first increment plans may be necessary.

Trade-off analysis of the standards which have been assigned to the second and third tiers are not presented. The attributes of these standards were such that they were assigned lower levels of priority, and are not being developed/implemented during the first increment.

8.1 POSIX

Analysis: POSIX

Relevant Attributes:

- process: CONSENSUS
- stage: APPROVED (Parts) DRAFT (Parts)
- relationships: CAIS-A
- sponsor: IEEE P1003, JTC1 SC21 WG15
- domain maturity: (operating systems) HIGH
- standard maturity: LOW
- availability: NONE (some companies claim conformance)
- relevance: (FRAMEWORK, HIGH), (TOOLS, HIGH), (APPLICATION, HIGH)
- involvement: Unisys, TOO MANY OTHERS TO ENUMERATE

POSIX has emerged as a central facet in application portability studies and open system architecture specifications. POSIX is crucial to STARS as a means of supporting portable CAIS-A implementations.

Besides the POSIX Ada bindings working group, other P1003 working groups are of interest to STARS, including: real-time, transaction processing, networking, and (newly forming) user interface extensions to POSIX. The POSIX committee in time has taken on a more broad-based set of issues pertinent to software environments than specification of interface standards to UNIX. STARS must be involved in the POSIX committee, and keep abreast of the widening POSIX scope.

An additional POSIX activity, the POSIX 1003.0 Guide to a POSIX-based Open System Architecture, is directly relevant to STARS, since this group may well specify a standards profile similar to the STARS profile described in this report. STARS influence and viewpoints must be visible in the 1003.0 study group in order to avoid incompatabilities with Ada requirements and emerging Ada environments.

Implementations of the POSIX/Ada bindings do not exist, and are not expected to be approved until some time in 1989. However, the need for Ada POSIX interfaces exists *immediately*, and warrants the specification and use of *draft* Ada POSIX interfaces.

Action: POSIX

Relevant Actions:

- participate
- propose
- white paper

The goal of the POSIX action is earliest stabilization of Ada bindings to the base POSIX definition, and continuing involvement in the POSIX extensions, including the POSIX GUIDE subcommittee. Further, issues pertaining to POSIX and CAIS-A interactions will be delineated.

Participate. Committee participation will put STARS in a position to have influence on the formal standardization process. This is especially important in the P1003.0 effort, as premature standardization on a POSIX profile could seriously inhibit STARS innovations. The Interface Standards team will actively participate in the Ada bindings (P1003.5), POSIX Guide (P1003.0), networking (P1003.net) and user interface (P1003.ui). Continuous and active STARS participation in these subgroups is important to ensure STARS influence in these areas. In addition, the Interface Standards task will actively monitor transaction processing and real-time POSIX extensions (P1003.tp, P1003.4, respectively).

Propose. Early (anticipatory) use of POSIX Ada bindings will establish a position to propose modifications to the Ada bindings, as needed, based upon hard-won experience. The Interface Standards team will directly participate in evaluation of draft Ada bindings to POSIX. The close working relationship between this team and the Unisys Baseline SEE team will facilitate the communication of CAIS-A derived POSIX requirements to the appropriate POSIX working group.

White Paper. A number of crucial issues regarding the relationship of POSIX to the emerging STARS SEE have emerged e.g., the relationship between POSIX and CAIS-A, which need to be addressed. The purpose of the white paper will be to address the broad implications of using POSIX as a base portability platform, and in particular to address the relationship of POSIX/CAIS-A interfaces, i.e., which interfaces should be used by STARS applications where there is overlap between CAIS-A and POSIX.

8.2 DIANA

Analysis: DIANA

Relevant Attributes:

- process: DE FACTO
- stage: PRE-PROPOSAL

- sponsor: NONE
- domain maturity: (compiler technology) HIGH
- user: TOOLS
- availability: PUBLIC DOMAIN PROTOTYPE
- relevance: (FRAMEWORK, LOW), (TOOLS, HIGH), (APPLICATION, LOW)
- involvement: STARS, IDA, Commercial Vendors
- influence: POTENTIALLY HIGH

DIANA presents an excellent opportunity for integration of tools sensitive to Ada syntax and semantics. As an intermediate language representation of Ada, DIANA provides tools access to static semantic attributes of Ada units stored in Ada libraries. Library-level integration can significantly augment the power of language sensitive tools. DIANA can be immediately useful for tool building tasks (Q10), as well as tasks focused on developing tools and methods particularized to Ada language support (Q18).

The underlying domain (compiler technology) is mature and stable. Therefore, although there are no sponsors or concrete virtual interface proposals, early stabilization of a standard DIANA interface is possible. The existence of a public domain prototype which is being supported by its developer is incentive to pursue further development.

However, the developer (Bill Easton, Peregrin Systems) is currently in the process of modifying DIANA in order to take advantages of lessons learned to produce a "production quality" implementation. Because of this, substantial first increment re-work on the DIANA implementation is not warranted. That is, performance tuning or major re-writes will not be cost effective. However, immediate use of DIANA is called for, despite potential performance problems. Further, proposal of a virtual interface standard is warranted.

As a major user and promoter of DIANA, Unisys is in an excellent position to drive DIANA standardization activity.

Action: DIANA

Relevant Actions:

- Port
- Evaluate
- Rehost
- Application
- Propose

- Implementor's Group

The goal of the DIANA task is rehosting of a public domain DIANA implementation into the STARS environment, and reinitiate efforts at standardizing the DIANA virtual interface via de facto standardization process.

Port. The DIANA developed under the IDA contract and made available to Unisys as STARS Prime contractor will be ported and made available to other Primes and subcontractors. Where necessary, minor extensions to facilitate ease of use will be developed.

Evaluate. The IDA DIANA implementation will be evaluated in terms of characteristics such as implementation modifiability, clarity, and, most importantly, correctness. The ACVC tests will serve as a basis for correctness testing.

Rehost. If, as expected, the quality of the DIANA implementation is adequate, it will be rehosted to the baseline STARS SEE. This involves, at a minimum, replacing DIANA IO with CAIS-A IO. Additionally, the Unix shell ("csh") scripts may be replaced with a master program making use of CAIS-A process control interfaces.

Application. Depending upon preliminary evaluation of DIANA quality, either of two types of application drivers may be developed. One application will be the replacement of the Gadfly[1] knowledge-based testing assistant front-end with DIANA. This effort is well scoped since there is a discrete set of packages in Gadfly to build an Ada parse tree as input to Gadfly inferencing; replacing this with DIANA will be straightforward, and will significantly enhance the prospects for Gadfly extensions. A second application driver option is development of a *semantics pretty printer*, which will in effect be a high-level dump of DIANA instances. This will facilitate examination of DIANA instances resulting from e.g. ACVC tests.

Propose. The DIANA implementation's virtual interface was inadequate because of constraints imposed by a deficient compilation system; a new interface shall be developed. This interface, based upon an interface proposed in the October 1982 draft revised DIANA reference manual, shall form the basis of a proposed standard. The interface will be developed and promulgated through the DIANA implementor/user group. Rapid promulgation of high-quality interfaces to DIANA will encourage the emergence of a DIANA de facto standard. The widespread use of this de facto standard should be encouraged as a means of achieving Mil-Std status for the DIANA interface.

Working Group. Several Unisys Q-tasks will make use of DIANA (Q14, Q10, Q18). Implementors within these tasks will be encouraged to participate in a working group to share experiences (i.e., bugs, deficiencies, extensions, etc.) with DIANA. The other Prime contractors and their subcontractors will be encouraged to participate.

8.3 The X Window System User Interface

Analysis: The X Window System

Relevant Attributes:

[1] Under contract of Naval Research Laboratory, contract N00014-88-C-2052.

- process: DE FACTO, EMERGING ANSI
- stage: PROPOSAL
- relationships: Xlib, Xr, Xt, networking
- sponsor: X3/ANSI, X-CONSORTIUM, STARS
- domain maturity: (windowing) MEDIUM
- standard maturity: LOW
- availability: PUBLIC DOMAIN "C" PROTOTYPES AND ADA BINDINGS
- relevance: (FRAMEWORK, HIGH), (TOOLS, HIGH), (APPLICATION, HIGH)
- influence: POTENTIALLY VERY HIGH FOR ADA BINDINGS

The importance of the X Window System to STARS cannot be overstated: X forms the basis for SEE tool and application bit-mapped user interfaces. Human factors aspects compel the development of tools which take advantage of this workstation technology. It is absolutely vital that stable Ada interfaces to needed X functions are available *before* significant tool-building efforts are undertaken.

STARS has made a substantial investment in X. The STARS foundations program, via SAIC, has provided the Primes with an Ada binding to the low-level X library, *Xlib*, as well as a toolkit binding to Hewlett-Packard's *Xr*. Each of these are *shallow bindings*, e.g., an Ada veneer over an underlying "C" implementation.

Additionally, under the option phase of this contract, SAIC is developing *either* a full Ada implementation of Xlib, *or* a full Ada implementation of MIT's toolkit, Xt. SAIC is currently negotiating this point with STARS.

Unisys has already integrated the Xlib bindings into the Ada Command Environment (ACE)[2] constructed under a STARS Foundations contract, and so a substantial amount of work necessary to rehost X in the STARS environment has already been accomplished. However, the Xlib functions do not provide a sufficiently high-level platform for constructing user interfaces. For these purposes the toolkit level bindings are needed. In fact, even the toolkits are low-level when compared to commercially available kernel-based windowing systems; thus user-interface management systems (UIMS) are being developed for X. UIMS provide a high-level front-end to toolkits. Toolkits are a prerequisite for implementation of user-interface generators.

In the long run, the Xr bindings made available by SAIC are not viable. The most important factor mitigating against the Ada Xr bindings is that Xr has been easily surpassed by the MIT toolkit, Xt, the emerging consensus standard. In fact, even Hewlett-Packard (the originator of Xr) has abandoned Xr in favor of Xt. In the long run tools constructed to conform to Xr will need substantial modification to work with Xt, since Xr "widgets" (toolkit objects) are constructed using toolkit "intrinsics" (built-in toolkit features) which are not compatible with Xt intrinsics.

The importance of Xt to the STARS SEE, both in terms of common tool interfaces and productivity-boosting user-interface generators, compels first increment action regarding toolkit-level interfaces.

[2]Under contract of the Office of Naval Research, contract N00014-87-C-0743

Action: The X Window System

Relevant Actions:

- participate
- port
- evaluate
- application
- propose
- white paper

The goal of work on the X Window System is to provide Ada interfaces to the X toolkit layer for use by the second increment, to understand the implications of mapping object-oriented toolkit specifications and implementations into Ada specifications, and to work towards standardization of the Ada interfaces to Xlib.

Participate. Unisys, at its own cost outside the Q14 task, is funding participation on X3H3.4 and X3H3.6. STARS input to these standards committees will be through this Unisys representative who will also serve as a consultant during Xlib and X toolkit (if appropriate) bindings design. This will put STARS on the *forefront of Ada-X standardization*.

Port. The SAIC Xlib and X toolkit shallow bindings (bindings to the Hewlett-Packard X-Ray, or Xr, toolkit) will be ported. Versions will be maintained to support Ada LRM allowable compiler dependencies (e.g., pragma interface).

Evaluate. The SAIC Xlib and Xr toolkit bindings will be analyzed for bindings methods. Shallow bindings (as opposed to deep bindings) will demonstrate a simplistic approach to toolkit level bindings. However, a substantial number of issues concerning the pragmatics of interfacing Ada data structures and types to C have been addressed by the SAIC work, and valuable lessons learned can be scavenged. More sophisticated bindings approaches will be required to achieve deep bindings, since the toolkits under development now are taking advantage of features found in object oriented languages such as C++. Although the concepts and constructs of inheritance and message-passing do have analogues in Ada, a thoughtful approach to achieving this mapping will ensure that Ada toolkit implementations will keep abreast of prototype implementations emerging from the X-consortium and MIT.

Application. Sample application programs will be constructed to test the successful porting of Xlib and Xr. These programs will be constructed to facilitate reuse of program features for construction of second increment tool user interfaces.

Propose. Higher quality Ada interfaces (as opposed to shallow bindings) will be designed for Xlib, for the latest release, X11r3. The Interface Standards team will use this definition as the basis for proposed Ada bindings to Xlib. Although the standards committee has not yet taken up language binding issues, early preparation will put STARS in a position of influence.

White Paper. It is not clear that the goal of language independence of X interfaces is being attained in the X Window System toolkit level. The pressures of constructing high-quality, flexible toolkit implementations in C may result in language dependencies. For example, the use of procedure and function addresses to attach code fragments to data structures (*callback* routines) does not appear to be in the spirit of Ada. The goal of this white paper will be to identify key issues in mapping object oriented language implementations in the C++ family into Ada. Although the Xt implementation is in C and not C++, it is clear that the C version is being "shoehorned" into C++-style. Apparent language dependencies in the emerging Xt definition will be identified and Ada analogs proposed. It is possible that even deep Ada bindings to an underlying C Xt implementation my be less appropriate than design of an Ada-oriented toolkit layer; this eventuality will be discussed in the paper.

8.4 IRDS

Analysis: IRDS

Relevant Attributes:

- process: CONSENSUS
- stage: APPROVED
- relationships: CAIS-A, SQL, DATABASE
- sponsor: X3H4, JTC1 SC21 WG3, NIST
- domain maturity: (database) HIGH
- standard maturity: MEDIUM
- availability: PUBLIC DOMAIN (PARTIAL) "C" PROTOTYPE
- relevance: (FRAMEWORK, MEDIUM), (TOOLS, HIGH), (APPLICATION, HIGH)
- influence: LOW

An Information Resource Dictionary is a shareable repository for a definition of the information (data, processes, users) relevant to an enterprise. A center of the universe notion seems to be an attribute of many standards bodies, and the ISO IRDS framework document illustrates this attribute with the following statement:

"The design of the IRDS standard is such that further standards can be developed subsequently to support such fields of application as the following:

1. computer assisted software engineering
2. system life cycle and project management

3. data element standardization and management
4. organizational planning
5. data administration and data base administration
6. distributed processing and distributed data bases
7. source and object library management
8. software and hardware configuration management
9. software testing and quality assurance
10. documentation and document administration"

There are not one but two IRDS standards being developed. The ANSI standard has been approved and adopted as a FIPS. The ISO standard is following a different path and is a year or more away from completion. The disagreement between the the IRDS standards groups is fundamental and includes hostility. The chairman of X3H4 which is responsible for ANSI IRDS has suggested that the TAG to the ISO IRDS be assigned to X3H2, the database group which has developed the SQL standard.

Both the ANSI and ISO groups have developed draft proposed services interfaces to the dictionary systems. These are the programmatic interfaces, Pascal language bindings are provided. While both groups intend to eventually have bindings to other languages, as far as we have determined no-one has indicated interest in developing Ada Language bindings. NIST has developed a public domain prototype of the ANSI IRDS, using the command language interface, written in C and implemented on top of an Oracle database. Commercial implementation of the ANSI IRDS are expected in the near future. These would be implementations of the command and menu interfaces only since the ANSI services interface is not yet adopted.

The STARS need for IRDS will not emerge until late in the second or perhaps into the third increments, when the software engineering processes are sufficiently crystallized to be modeled via a conceptual schema. If the need for IRDS is to be satisfied, early fundamental work on Ada interfaces to IRDS needs to begin now. Additionally there needs to be close communication between the Interface Standards group and the system architects and developers of the tools which will make use of an IRDS.

Action: IRDS

Relevant Actions:

- participate
- evaluate
- analysis

- propose
- white paper

The goal of the IRDS task to begin fundamental activities necessary to ensure timely insertion of IRDS systems into the STARS SEE. Modern IRDS are complex systems, and the deployment of an IRDS in a CASE context raises complex issues, e.g. data distribution, security, integrity and consistency, support for disparate data models, relationship with CAIS-A node model, to name a few. Before committing to an IRDS approach, technical issues as well as political issues (e.g., the competing, conflicting ANSI and ISO IRDS approaches) need to be identified and resolved.

Participate. The Interface Standards task will participate in the X3H4 IRDS committee; this participation will provide STARS with access to IRDS technical competence, and will provide X3H4 with a valuable Ada perspective on the emerging IRDS service interface standards. Both ANSI and ISO IRDS standards will specify procedure interfaces to IRDS services; an opportunity for anticipatory Ada standardization exists now.

Other standards efforts are related to IRDS, e.g., POSIX 1003.0 and X3H2 (SQL). Both of these activities are discussed elsewhere in this report. The Interface Standards task will track the intersection of activities in these committees.

Evaluate. We have acquired the NIST prototype implementation of the ANSI IRDS with a command language interface, written in C, and interfaced to an Oracle database system. This implementation will be evaluated as a part of the IRDS analysis.

Analysis. The analysis of IRDS will include not only technical approaches to pursuing the development of the IRDS modules and service interfaces, but also of the process which is required in order to encourage a dialog among interested parties within the STARS community, so that the IRDS is a consideration in planning for other STARS components. Establishment of this dialog is a top priority, and an interim IRDS report will be released in the short term for the purpose of initiating this dialog. The Interface Standards team will aggressively seek out industry experts within the Primes and their subcontractors in order to identify and scope IRDS/STARS issues.

Proposal. The development of Ada Language bindings to the services interface is a task which has several important side effects: it will provide visibility and credibility for STARS within the IRDS standards group, it will provide a technical explanation of IRDS functionality to the STARS community, and it will lay the foundation for the adoption of standard Ada bindings.

White Paper. As already noted, the use of IRDS in CASE environments raises fundamental issues which need to be addressed. A byproduct of the IRDS analysis will be a STARS white paper describing the context which IRDS can/will occupy within the STARS program.

8.5 OSI

Analysis: OSI/Ada

Relevant Attributes:

- process: CONSENSUS
- stage: APPROVED
- relationships: CAIS-A, POSIX, TCP/IP and other DCA protocols
- sponsor: GOSIP, X3T5, JTC1 SC21
- domain maturity: (networking) HIGH
- standard maturity: HIGH
- relevance: (FRAMEWORK, HIGH), (TOOLS, HIGH), (APPLICATION, HIGH)
- influence: POTENTIALLY HIGH

Networking standards have long been considered of central importance to the construction of open systems (hence the OSI acronym, "Open System Interconnection"). The importance of OSI has been recognized by the federal government; the Government OSI Profile (GOSIP) mandates a subset of the OSI protocols for future government procurements. Although a two year transition period allows functionally equivalent protocols to be used (e.g. TCP/IP), the DoD is committed to making the transition from the DCA TCP/IP to OSI protocols in the near term.

The OSI protocols are crucially important, and will make possible the development of STARS components distributed across heterogeneous networks and hardware. Although the DCA protocols TCP and IP provide nearly equivalent services to those provided by layers 4 and 3 (respectively) of the OSI model, reliance upon TCP/IP may result in a tighter coupling to *protocols* that are being transitioned out of use than is desirable.

The OSI layered model is specified in terms of services provided by each layer; the functions of higher layers are based upon services provided by lower layers. This model presents a close analog to Ada packages, and specification of OSI via package specifications would provide protocol independent access to OSI. That is, although peer processes must share the *same* protocol, the application programmer need not be aware of *which* protocol is in fact used.

However, there are important issues that are raised by OSI that need to be addressed both within the formal standards arena, as well as within STARS technical development teams. Standardization issues include conflicting views concerning allowing application access to lower layers of OSI (layers 6 and below). Technical issues include the potential disharmony of migration to OSI with existing TCP-based implementations.

The emerging importance of OSI in conjunction with the degree of uncertainty concerning standardization and technical (pragmatics) issues indicates that active monitoring, participation, and analysis are required prior to development of Ada OSI implementations and bindings.

Action: OSI/Ada

Relevant Actions:

- active monitor
- participate
- white paper

The goal of the OSI task is identification of key standardization and technical issues of OSI and GOSIP pertinent to STARS objectives, and development of a STARS position on conformance to GOSIP and OSI.

Active Monitor. The JTC1 SC21 and X3T5 organizations responsible for the OSI specifications will be actively monitored, and the status of the several OSI protocol and subprotocol standards tracked. This monitoring will be done in conjunction with monitoring of GOSIP developments; although GOSIP is a FIPS, there is still a degree of instability here.

Participate. Committee participation pertains to the newly formed POSIX P1003.net networking group. GOSIP is certain to play an important role in the emerging POSIX networking discussions, and active, informed participation by STARS on this committee is needed.

White Paper. Some issues raised by migration towards OSI via GOSIP have already been raised in this report. There are different interpretations of OSI concerning application access to lower layers of the OSI model. The existence of many TCP/IP based applications argues for permitting at a minimum access to layer 4 of the OSI model; however, this complicates user applications since peer processes must communicate at the same OSI layers. More liberal permissions to access all layers *would compound* this problem. This issue is confronted again where the X Window System is concerned; X defines a protocol which, to be in strict conformance with OSI, would need to provide layer 6 services if it were to be considered (as it is now by virtue of its direct use of a layer 4 equivalent protocol – TCP) a layer 5 protocol. These and other issues need to be addressed and analyzed; the results will appear in a STARS white paper.

8.6 GKS

Analysis: GKS/Ada

Relevant Attributes:

- process: CONSENSUS
- stage: APPROVED
- sponsor: FIPS, X3H3.5 X3H3.4, JTC1 SC24
- domain maturity: (graphics) HIGH
- standard maturity: HIGH
- availability: PUBLIC DOMAIN

- relevance: (FRAMEWORK, LOW), (TOOLS, MED), (APPLICATION, HIGH)
- influence: HIGH

Functionally, GKS fits into a number of STARS standards profile families: data interchange (embedded graphics), user interfaces, and graphics. Although GKS is an "old" standard (a relative term in a fast-paced sector of the industry), and is facing some competition from more advanced graphics standards (e.g., PHIGS), it still has a niche for applications which do not require the complexity and overhead of PHIGS.

There is no *early* need for GKS per se, since environment tools in the early increments will find X-graphics sufficient. However, early use of GKS as an exploratory vehicle for solving problems associated with having graphics interfaces (GKS, PHIGS) share the same device with X is appropriate. Whether or not PHIGS supersedes GKS, or whether a new graphics standard emerges to replace GKS and PHIGS, the co-existence of several applications drawing to the same window presents technical issues which must be addressed.

Since a Unisys subcontractor (STI) has significant experience with Ada GKS, and Ada graphics in general, early insertion of GKS into the STARS SEE via an X device driver satisfies two objectives: 1) provide virtual interface for application graphics capability, and 2) solve problems of cooperation between X and other graphics systems. It is clear that the Unisys use of X as the SEE windowing environment means that addressing the interaction between X and graphics systems in general will be important, and that the GKS/X work will provide an understanding of these issues.

Action: GKS/Ada

Relevant Actions:

- Rehost
- Application

The goal of the GKS task is to rehost GKS to the STARS SEE via the X-window system. Besides providing virtual interfaces for constructing graphical user interfaces, this task will address larger issues of integration of graphics systems into the X Window environment.

Rehost. The Ada GKS implemented by STI for STARS Foundations will be rehosted to the baseline SEE. The integration of GKS will be accomplished by implementation of an X-driver. This will provide SEE applications with the capability of using GKS to draw on single X windows, rather than needing to take over the entire workstation display area.

Application. STI will provide an application demonstrating the successful integration of GKS and the X-Window System.

8.7 SQL/Ada

Analysis: SQL/Ada

Relevant Attributes:

- process: CONSENSUS
- stage: PROPOSAL
- domain maturity: (database) HIGH
- standard maturity: LOW
- completion date: UNKNOWN
- availability: PUBLIC DOMAIN (PARTIAL) PROTOTYPE
- relevance: (FRAMEWORK, LOW), (TOOLS, HIGH), (APPLICATION, HIGH)
- influence: LOW

In his guide to the SQL standard, C.J. Date reports that in 1987 there were fifty or so SQL implementations available, no two of them were identical and none were identical to standard SQL[CJDate 87]. Date asserts that SQL is far from ideal as a relational language, that standard SQL is severely deficient in several respects, yet the standard exists, vendors are scrambling to support it, and the state of affairs may possibly change with time. The state of affairs concerning Ada and SQL is also unstable and unsatisfactory.

The three basic approaches are: 1) embedded SQL; 2) standard procedure interface method; 3) Ada Module Extensions.

The appendices to the SQL standard provide definitions for embedded syntaxes. These are short hand for the equivalent separate module and host programs which are specified in the standard. Vendors, including Informix, Oracle, and RTI INGRES are implementing the embedded SQL approach which requires preprocessing.

The standard procedure interface method was the approach taken by the Institude for Denfense Analyses (IDA) and the WIS JPMO in developing draft Ada bindings. In this approach SQL syntax is expressed in compilable Ada. Grumann has developed a prototype implementation of the WIS bindings.

Under a STARS Foundations contract, Lockheed developed a prototype implementation using the standard procedure interface method. Some reported disadvantages of the Lockheed implementation are the lack of support of joins and the lack of support for dynamic creation of relations. Another STARS task (Q13) has responsibility for evaluating the STARS Foundations capabilities.

The SQL Ada Module Extensions (SAME) project is based on the SQL module interface which is the official interface to ISO-ANS SQL. In October, 1988 the Software Engineering Institute issued a draft version of its Milestone Report "Guidelines on the use of SAME" for review. In October, 1988 the first SQL Module Compiler was delivered to the Army by Compass, a subsidiary of Applied Data Research. On November 7, 1988 the Congress Business Daily reported that, based on an unsolicited proposal from Intermetrics, the Naval Research Lab will let a contract for the development of a full production quality implementation of an SQL/Ada module compiler and to support the SEI committee developing guidelines.

The most appropriate action for the Interface Standards task is to actively monitor and, where appropriate, participate in Ada SQL workshops, working groups, and committee activities. Because of the large number of Ada-SQL developers any first increment development activities are likely to have diluted if not duplicative effect. Current approaches to Ada-SQL should be evaluated and an explicit statement of STARS position on Ada-SQL formulated.

Action: SQL/Ada

Relevant Actions:

- participate
- active monitor

The goal of the SQL activity is to formulate a Unisys/STARS position on Ada SQL, and participate in the appropriate committees to apply our influence on behalf of this position.

Participate and Active Monitor. STARS, through the Interface Standards team, will monitor for consensus and convergence of Ada SQL approaches, and take action to incorporate Ada SQL when the technology is sufficiently mature. In addition, the Interface Standards task chief programmer will serve as reviewer of the SEI's "Guidelines for use of SAME (SQL Ada Module Extensions)."

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A Application Portability Studies

"This study will involve a number of disciplines and could have a broad effect on information technology standardization activities over the next decade."
A characterization of the international study on application portability.

This appendix is the result of *Active Monitoring* of certain standards groups. It reports on the history, focus, and October 10, 1988 status of the IEEE P1003.0, POSIX Guide work and on the application portability studies related to the work of the JTC 1 Technical Study Group #1 (TSG-1).

Architectures such as the STARS SEE may be considered users of the standards profiles and/or reference models which are under development in de facto and consensus standards organizations. To illustrate: at a meeting of the IEEE 1003.0 POSIX Guide group last July, Fritz Schultz of Ford Aerospace presented the Space Station Information System (SSIS) architecture, including the mandating of SSIS standards for each slot in the model. Schultz expressed hope that the POSIX Guide work would provide much of the framework and standards selection for SSIS, from which SSIS could leverage its work (P1003.0/N14, N33). The POSIX Guide and the work of the other studies on application portability can be expected to provide similar leverage to the selection of standards for the STARS SEE.

A.1 The Players: Organizations & Individuals

There is a community of individuals and organizations working toward the development of sets of formal and informal standards which work together for application portability. These are some of the projects which are defining application portability profiles, reference models, or architectures: the IEEE P1003.0 POSIX Guide, the NIST Application Portability Profile (APP) standards project, the U.K. Central Computer and Telecommunication Agency's (CCTA) Open Systems Architecture Program, Japan's JISC Systems Software Interface (SSI) standards project, and programs of work by X/OPEN and the Open Software Foundation (OSF). Most recently, and most importantly, there has been the establishment of an Application Portability Study Group under the aegis of the JTC 1 Special Working Group on Strategic Planning (ISO/IEC/JTC1/SWG-SP/APSG). For easy reference this study group has been officially designated as JTC 1 Technical Study Group #1 (TSG-1).

From the US perspective, there are five main groups working on application portability. They are X3/SPARC/APSG, JTC 1 TAG APSG, P1003, JTC 1 SC22/WG15, and JTC1 SWG/SP-APSG (TSG-1). Their arenas are X3, all of US, POSIX, POSIX worldwide, and application portability worldwide respectively. For simplicity, we will discuss the X3/SPARC/APSG and JTC 1 TAG APSG work in the context of TSG-1 and ignore the international POSIX work since we have not reviewed any documents from JTC 1 SC22/WG15.

The POSIX Guide work, by IEEE P1003.0, and the JTC 1 application portability study, by TSG-1, were both initiated during 1988 to address interface standards for application portability. Both groups are meeting in October, 1988, and their work will take into account the work of the other groups listed above: NIST, OSF, X/OPEN, CCTA, and SSI. Among the participants in the P1003.0 group are *individuals* from NIST (chair), X/OPEN (document editor), CCTA, OSF, AT&T, IBM, Unisys, DEC, and GM. The US delegation to TSG-1 also has *individual* representatives.

There is an important intersection of participation in the various application portability studies. The US delegation to TSG-1 has six individual members: they are:

Jon Becker - Unisys
: Becker and his collegue, John Hill of Unisys are both members of the JTC 1 TAG APSG. Hill is the Unisys representative to X3/SPARC/APSG, and. a member of P1003, P1003.1 and P1003.0

Robert Follett - IBM
: Follett chairs the X3/SPARC/APSG.

Jim Isaak - DEC
: Isaak is chair of IEEE P1003 and of P1003.1.

Roger Martin - NIST
: Martin's colleague, Allen Hankinson, chairs P1003.0.

Stephen Carpenter - OSF
: Carpenter made an OSF presentation at the July P1003.0 meeting.

Jack Veenstra - AT&T, Bell Labs

A.2 P1003.0 - POSIX Guide

The "Guide to POSIX Based Open System Architecture" being developed by the POSIX Guide Working Group, IEEE P1003.0, will clearly be an important educational document discussing existing standards, their inter-relationships, the "holes" where standards are needed, and various de facto specifications (OSF, X/OPEN) and government requirements. Whether the guide goes beyond being a tutorial on standards and establishes a reference model or standards profile, based on POSIX and a group of selected standards, has not yet been resolved.

P1003.0 is chaired by Allen Hankinson of NIST, and the document editor for the Guide is Mike Lambert of X/OPEN. The starting point for P1003.0 discussion was the NIST Application Portability Profile (APP), presented by Hankinson (See Table 1). In the Federal Information Processing Standards (FIPS) version of the basic POSIX Standard (P1003.1), the NIST APP appears as an appendix, but this appendix is *not* a part of the POSIX Standard. In the March, 1988, meeting of the POSIX Guide group, a claim was made that "The output of the (POSIX Guide) group's effort would be more than a paper guide, because the U.S. Federal computer user community saw the P1003.0 working group as a forum for establishing a consensus architecture that would be the basis for future computer system procurement."

The October 24-28, 1988 meeting of IEEE P1003 will include the third meeting of P1003.0. The Interface Standards team has reviewed all of the P1003.0 documents and will become active in this committee. John Hill of Unisys is a member of the P1003.0 committee. Jim Lonjers, Unisys STARS Q14 and Q8 Manager, is an active member of the POSIX Ada bindings committee, P1003.5, and he will become active in P1003.0 as well. Jim Moore, IBM STARS System Architect, is liaison from P1003.5 to P1003.0. Note that IEEE P1003 memberships are individual and these organizational designations are given simply as reference.

At the July P1003.0 meeting there were presentations concerning OSF, X/OPEN, CCTA, graphics standardization work (X3H3), the POSIX Ada bindings committee (P1003.5), PCTE, MAP, SSIS, the X Window System, Network Standards, and data interchange standards such as SGML, IGES, and PDES.

While the P1003.0 documents have been an invaluable resource to the Unisys STARS Q14 team, we must report that John Hill has expressed concern over the process (or lack of it) operating within this committee. At the July meeting in Denver, Hill expressed his concerns in a formal statement and several other participants have raised concerns about the indicated scope and objectives of the committee. The July minutes summarize Hill's suggestions:

1. Adopt a top-down approach in this effort.
2. Define terms completely and agree on the definitions.
3. Define a model to guide the application portability work.
4. Define a reasonable decomposition of the task, considering the degrees and domains of portability,
5. Formalize the operation of the committee, including tracking assigned work items and taking care in determining consensus.

IEEE P1003 is the committee developing POSIX, and it consists of the US TAG to the international POSIX group JTC 1 SC22/WG15 (plus all of its technical committees). The POSIX work contains several projects. The central work, done by P1003.1, has produced the "basic POSIX" a proposed ANSI standard. The P1003.1 draft has already been adopted by NIST as a Federal Information Processing Standard (FIPS 151), with the NIST APP as an appendix. Such groups as OSF and X/OPEN are expected to adopt POSIX as a standard. POSIX Ada bindings work is being done by P1003.5. Other P1003 committees are working on various extensions to POSIX and three new projects will be considered at the October meeting. One of these projects concerns networking and a representative from MAP/TOP has corresponded with the P1003 chairman concerning the POSIX networking project and the existence of language independent application interfaces which have been developed by MAP/TOP. As indicated in the OSI action plans, the Interface Standards team will participate in the work of the POSIX networking group as well as in the POSIX Ada Bindings and POSIX Guide working groups.

A.3 Technical Study Group #1 (TSG-1)

The JTC 1 Special Working Group on Strategic Planning - Application Portability Study Group (JTC 1/SWG-SP/APSG) also known as Technical Study Group #1 (TSG-1) is having its first meeting in Tokyo, October 11-14, 1988. The JTC 1 resolution establishing TSG-1 was based on recommendations from two JTC 1 special working groups: the Special Working Group on Strategic Planning (SWG-SP) and the Special Working Group on Software System Interfaces (SWG-SSI), a group which had been studying the Japanese Software System Interfaces (SSI) proposal over a period of about eighteen months. The resolution which established TSG-1 simultaneously disbanded

SWG-SSI, accepted the technical study recommended by SWG-SP, stated that a particular SWG-SSI document should be used as a reference document in the study, and requested that Japan would convene TSG-1 and perform secretariat responsibilities.

Along with the establishment of the international TSG-1, a corresponding US JTC 1 Technical Advisory Group Application Portability Study Group (TAG/APSG) has come into being. This group appointed the delegates (listed above) to the Tokyo October 11-14 meeting, and developed a U.S. position paper in advance of that meeting. Additionally, an X3 Strategic Planning and Requirements Committee Application Portability Study Group (X3/SPARC/APSG) has been established. The X3/SPARC/APSG has commented on the TAG/APSG position and made recommendations for the organization of TSG-1 subtasks. Q14 has reviewed documents relating to TSG-1 which have emanated from five groups: the two JTC 1 special working groups which recommended the formation of TSG-1 (SWG-SP and SWG-SSI), the US TAG/APSG to TSG-1, the X3/SPARC/APSG, and JTC 1/SC21/WG7 which is developing the Basic Reference Model of Open Distributed Processing (ODP). Documents from these five groups indicate the direction and importance of the TSG-1 work. Following the first meeting of TSG-1 in October, 1988, additional TSG-1 documents will be reviewed by Q14.

A.3.1 TSG-1 Charter: Special Working Group on Strategic Planning (SWG-SP)

A SWG-SP document (JTC 1-N236, Annex B) provides the charter for the scope, task and methodology for TSG-1. The following is a very close paraphrase of that document.

- Technical Study: Standards Necessary to Define Interfaces for Application Portability.
- Scope: The objective of standards in the area is to enable users to project their investment in application development by allowing application programs operating in one hardware/operating system environment* to operate in another. *For example, environments which include, but are not limited to: Operating Systems, Databases, Languages, Data Interchange, Systems Interworking, Network Services, User Interfaces.
- The Task:

  Stage A - REQUIREMENTS DEFINITION

  A.1. To define user requirements for application portability by examining such work as already exists and by inviting contributions from interested parties.

  A.2. To describe those requirements in terms of functionability, its elements, the specific functions and the related standard interfaces required.

  A.3. To identify the feasibility and practicability (including time scale) of meeting those requirements through standardized interfaces.

  Stage B - ANALYSIS

  B.1. To identify what relevant standards exist and what work is in progress, identifying where it is taking place.

  B.2. To comment on the relevance and adequacy of the work.

  B.3. To specify any additional work required involving both architectural studies and NWIs.

Stage C - CONCLUSION

C.1. To propose any modification required to existing work programs.

C.2. To suggest to JTC 1 SWP-SP where new work should be done.

- Methodology:

Reports at the end of stages A, B, and C

Detailed study program to be presented to SWP-SP at its meeting in December, 1988

first iteration of the tasks in Stage A to be completed by mid 1989

A.3.2 US TAG/ASPG & TSG-1

The United States position on the application portability study underway within JTC 1 Technical Study Group #1 (TSG-1) was prepared by the JTC 1 Technical Advisory Group Application Portability Study Group (TAG/APSG) to TSG-1. The document (JT/88-396-AP) is a draft of the US position.

The US position is that the central task of the TSG-1 shall be the development of an Application Portability Framework, or Model. This would begin with a review of the current work, including the POSIX Application Portability Guide, the X/OPEN Portability Guide, and the Open Software Foundation (OSF) Application Environment. Then, a comparison of current JTC 1 work with the model will permit the identification of relevant standards which currently exist or are under development in JTC 1. The comparison would identify any possible functional overlap and could yield recommendations for new work and/or the need for some reorganization of JTC 1 in order to effectively address standards requirements for application portability.

The statement recommends a top down approach, brought together in a description of a functional interface model. The position recommends that the agenda for the October meeting should include a review of the existing work done in this area by the POSIX Guide group (P1003.0), X/OPEN, OSF, the NIST APP, CCTA, ECMA, CIE/CASE, and vendor architectures. The work by P1003.0, X/OPEN, and OSF and possibly by vendors may be submitted by the United States. The position goes on to state the necessity for an understanding of terms (such as application, portability, and interface) and problem definition (user issues, technical issues, application environments, and standards issues). Following this preliminary work, the central task, the development of the Application Portability Framework, or Model could begin. This task would include a review of current framework/model work, consideration of the requirements for the model, and then preparation of the model. Following model preparation there would be the identification of relevant standards and the identification of needed new work. Because of the breadth of the study area, subtasks should be identified, and developed by subgroups.

A.3.3 X3/SPARC/ASPG & TSG-1

The X3/SPARC Application Portability Study Group (X3/SPARC/APSG) recommended to TSG-1 (through the US JTC 1 TAG/APSG) that subtasks should be based on functional profiles for various application environments such as office, commercial, scientific, realtime, industrial automation, etc., and that the subtasks be addressed by Ad Hoc subgroups (APSG/88-017).

X3/SPARC Software Systems Interface Study Group (X3/SPARC/SSISG) has been reconstituted as the X3/SPARC/APSG, under the chairmanship of Robert Follett of IBM. The scope and program of work for this SG has been defined in a committee document (X3/SPARC/APSG/88-001). The X3/SPARC/APSG is a focal point for X3 input into JTC 1 TAG/APSG. Similarly P1003.0 is a focal point for IEEE POSIX input into JTC 1 TAG/APSG The extent to which there will be a divergence of viewpoint by SPARC/APSG and IEEE 1003.0 as these two groups prepare input for JTC 1 TAG/APSG remains to be seen. In the words of Follett: *This study* (TSG-1) *will involve a number of disciplines and could have a broad effect on information technology standardization activities over the next decade.*

Follett is establishing communication concerning the X3/SPARC/APSG with all X3 committees working on standards which will be involved in the application portability work. For example, current work on reference models for graphics and Open Distributed Processing (ODP) will intersect with TSG-1 work and also with POSIX Guide work. A concern about the intersection of graphics work and P1003.0 work was raised at the July P1003.0 meeting by George Carson, a representative of JTC 1/SC24, the international graphics standards committee. As described in the following sections, the relation between the ODP reference model work and the application portability study has also been a matter of discussion.

A.3.4 Open Distributed Processing (ODP) & TSG-1

JTC 1/SC21/WG7 which is developing the reference model for Open Distributed Processing (ODP) has commented on the relationship of their work to the work of TSG-1 in (JTC 1/SC21/WG7 N 019). The ODP committee states:

- The (ODP) Basic Reference Model will not define programmatic interfaces, but will identify areas in which programmatic interfaces may be required.
- Projects for "ODP standards" to define programmatic interfaces will need to be considered separately.
- The intention is that projects to define the standards will be assigned within SC21.
- SC21/WG7 considers that the relation between ODP to the application portability study is satisfactorily defined by the output of the JTC 1 SWG-SSI, JTC 1-N22.

The referenced document defining a relationship between ODP and the application portability study is described in the following section.

A.3.5 TSG-1 legacy: SWG on Software Systems Interface (SWG-SSI)

The swan song of SWG-SSI was the development of a document (JTC 1-N22) which may be used as a reference document for TSG-1. These are the *recommendations* of SWG-SSI. They will not necessarily be followed and in fact that do not particularly co-incide with the US JTC 1 TAG/APSG recommendations described above.

Area of Work: Identify functions whose standardization would contribute to application portability and specify those for which:

1. there is an existing JTC 1 standard but no existing language binding;
2. there are alternative JTC 1 standards or standardization projects which could be used to achieve the same objective and are inconsistent;
3. there is no existing JTC 1 standardization effort.

Initial Work: The initial effort will address one representative case in each of the three categories as identified in the area of work. Additional cases will be addressed as the needs are identified. At this time no new work items are being proposed, but identification of some new work items at a later stage is not precluded. The three representative cases are:

1. Open Systems Interconnection (OSI). Language-independent interfaces will be identified for selected OSI Application Service Elements (ASE) and the binding of those interfaces to specific languages(s) will be recommended.
2. Windowing. Work on windowing and related topics is under way in a number of JTC 1 committees. Specific areas of overlap will be identified and recommendations will be made to JTC 1 as to the resolution of any inconsistencies.
3. Multi-byte Character Handling. Functions and services will be identified for generic multi-byte character set handling. Recommendations will be made for incorporating these functions and services into appropriate JTC 1 standards.

ODP relationship:

1. In identifying interfaces required for application portability one input would be the current state of the ODP reference model.
2. If interfaces are identified which are not yet reflected in the ODP reference model, those interfaces shall be considered for inclusion in the ODP reference model.

B Glossary of Terms

ANSI American National Standards Institute

APP Application Portability Profile, in particular the NIST APP.

ASN.1 Abstract Syntax Notation 1. ASN.1 is a language designed for use as a descriptor of data types and data values, in an abstract syntax. This abstract syntax is mapped to a bit level representation via Basic Encoding Rules (IS 8825).

CAIS-A Common Apse Interface Set in Ada. Promotes tool portability/interoperability by providing a standardized set of calls for operating system services. Relevant standard: DOD-STD-1838A (proposed).

CBEMA Computer Business and Equipment Manufacturers Association; holds the secretariat for X3.

CCITT International Telegraph and Telephone Consultative Committee

CGM Computer Graphics Metafile specifies a file format suitable for the description, storage, and communication of graphical information in a device independent manner. FIPS 128 and ANSI X3.122-1986.

CGI Common Graphics Interface specifies a set of functions for basic control and data exchange between the device dependent and device independent levels of the graphic system. ISO DP9639.

Common language-independent data types A work item shared by X3T2 and JTC 1 SC22 WG11, with X3T2 taking the lead. The standard will define specific data types by assigning identifiers for each type, specifying the external physical representation of each type,the conditions under which each representation may or must exist, and specific mappings between data types. The standard will include specific procedures for modifying the range of data types to allow new types to be included in the standard as they become necessary.

Common language-independent procedural calling mechanisms A work item shared by X3T2 and JTC 1 SC22 WG11 with WG11 taking the lead. The common language-independent procedural calling mechanisms standard will identify the calling environment for passing parameters from one procedure as arguments to another. It will address remote as well as local calling mechanisms, and is intended to integrate with ASN.1 (IS 8824, 8825), Presentation Service (IS 8822) and Remote Operations Service (IS 9072).

COS Corporation for Open Systems - organization formed by vendors to speed the acceptance and use of OSI.

DIANA Descriptive Intermediate Attributed Notation for Ada - An intermediate language for Ada.

DIS Draft International Standard (JTC 1)

DP Draft Proposal (JTC 1)

DBSSG X3/SPARC Data Base Systems Study Group. - An X3 study group; studying Data Base Management Systems and TC97 N1526, Reference Model for DBMS Standards.

ECMA European Computer Manufacturer's Association. Publishes standards on a wide range of topics, effective at getting its standards adopted internationally. Includes major US vendors, such as Unisys, that manufacture in Europe.

GKS Graphical Kernal System. Specifies a library of subroutines for an application programmer to incorporate within a program in order to produce and manipulate two dimensional pictures. Promotes portability of graphics application programs between different computers. FIPS 120, ANSI X3.124-1985 and ISO 7942.

GKS-3D GKS with 3 dimensional enhancements.

GOSIP Government OSI Profile; A subset of mandated OSI standards, mandated for government procurement. FIPS 146.

Guidelines for Language Bindings This is a technical report being developed by JTC 1 SC22 WG11, Techniques for Bindings. This report, edited by Madeline Sparks, Unisys Ada Defense Initiative, attempts to capture lessons learned from past binding efforts, and to provide guidelines to other binding activities. The intent of this report is that it be a comprehensive resource for all binding efforts within JTC 1.

IEC International Electrotechnical Commission.
Two of its committees were merged into ISO/IEC/JTC 1.

IGES Initial Graphics Exchange Specification is a neutral data format for the digital exchange of data between all current two dimensional computer aided design systems. MIL-D 28000

IRDS Information Resource Dictionary System. A database of information resource descriptions that can be used by a wide variety of software tools used in the management of information resources. ANSI X3.138-1988.

ISP International Standard Profile. Organizations which develop functional standards may follow certain procedures and submit standards to be adopted as an ISP. JTC 1 has a Special Group on Functional Standardization (SG-FS) which is involved in this process.

ISDN Integrated Services Digital Network – the beginning of standards for true voice and data integration.

ISO International Organization for Standardization.

JTC 1 - Joint Technical Committee #1. The ISO/IEC Joint Technical Committee 1 (JTC 1) on Information Technology was established in 1987 by the IEC and the ISO. The technical committees forming the original components of JTC 1 were ISO TC97 - Information Technology and all its subcommittees and IEC TC83 - Information Technology Equipment and IEC SC47B - Microprocessor systems.

MAP/TOP Manufacturing Automation Protocol and Technical and Office Protocol. Implementations of OSI, providing OSI protocols for manufacturing, engineering, and office environments. GM originated MAP, Boeing originated TOP. These OSI protocols have been widely used (800 companies) over the past two years.

NIST - National Institute of Standards and Technology. The National Bureau of Standards (NBS) was renamed to NIST August 23, 1988.

NIST APP - NIST Application Portability Profile; included as an appendix to the federal POSIX standard, FIPS151.

NWI New Work Item (JTC 1)

OSI Open System Interconnection is the ISO seven layer network communication protocol.

OSF Open Software Foundation - Announced May 17, 1988. Non-profit R & D for design and development of open software. Seven initial sponsors are: Apollo, Groupe Bull, Digital, Hewlett-Packard, IBM, Nixdorf, and Siemans.

P1003 IEEE 1003. POSIX standards committee.

- **P1003.0** POSIX Guide Working Group
- **P1003.1** Basic POSIX. Portable Operating System for Computer Environments
- **P1003.2** Shell and Application Utility Interface for Computer Operating System Environment
- **P1003.3** Standard for Test Methods for Measuring Conformance to POSIX
- **P1003.4** Real time Extensions for Portable Operating Systems
- **P1003.5** POSIX Ada Language Binding
- **P1003.6** Security Extensions for POSIX
- **P1003.net** Network Precursor Activity (in formation)
- **P1003.admin** Administered Systems Precursor Activity (in formation)
- **P1003.tp** Transaction Processing (in formation)
- **P1003.ui** User Interface (in formation)

PDES Product Definition Exchange Specification is similar to IGES, however it is three dimensional and geared to provide communication from preliminary design through product manufacturing.

PDISP Proposed Draft International Standard Profile (JTC 1)

PHIGS Programmers Hierarchical Interactive Graphics System is a device independent three dimensional graphical interface which allows application portability across heterogeneous systems.

POSIX - Portable Operating System Interface - POSIX and its extensions are developed by IEEE 1003 and JTC 1 SC21 WG 15. Defines a standard operating system interface and environment to support application portability at the source level.

POSIX Guide - The project of IEEE 1003.0. Guide to a POSIX-based open systems architecture.

SC subcommittee; as a proper noun refers to a standards subcommittee in the international arena, for example SC24 means IEC/ISO/JTC 1/SC24.

SC21 JTC 1 SC21 for Open Systems Interconnection

- **SC21 WG1** OSI Architecture
- **SC21 WG3** Database

SC21 WG4 OSI Management

SC21 WG5 Specific Application Services

SC21 WG6 OSI Session, Presentation and Common Application Services, includes ASN.1.

SC21 TAG U.S. TAG to SC21 - This group is doing a survey of DBMS Related Standardization Activities. - not the same as the SPARC/DBSSG Data Base Systems Study Group.

SC22 JTC 1 SC22 for Programming Languages

SC22 WG11 Includes Language Independent Datatypes and Language Independent Procedure Calling Mechanisms.

SC22 WG15 POSIX

SC22 TAG U.S. TAG to SC22 - Technical Report on Binding Techniques for Programming Languages comes under this group.

SC24 JTC 1 SC24 for Graphics

SG-FS JTC 1 Special Group on Functional Standardization. Involved in the process of the adoption of International Standards Profiles (ISP).

SGML Standardized Generalized Markup Language for document preparation, storage and retrieval of textual data. MIL-M 28001.

SPARC Standards Planning and Requirements Committee, particularly X3/SPARC. Analogous to the Special Working Group on Strategic Planning (SWG-SP) within JTC 1.

SPARC/APSG X3/SPARC Application Portability Study Group. A group under X3/SPARC studying application portability.

SSI Software System Interface; either the Japanese SSI program or the disbanded studies in SSI such as the JTC 1 SWG-SSI and the X3/SPARC/SSISG.

SQL Structured Query Language. Originally an IBM query language for relational databases, it has become the industry standard as well as an ANSI and ISO standard. FIPS 127, ANSI X3.135-1986.

SVID System V (five) Interface Definition. It is used in the phrase "SVID conforming" meaning that it has the same interfaces and is thus compatible with System V UNIX from AT&T. The only systems which really pass the test are direct derivatives from AT&T UNIX.

SWG-P JTC 1 Special Working Group for Procedures

SWG-SP JTC 1 Special Working Group for Strategic Planning

TAG/APSG JTC 1 Technical Advisory Group - Application Portability Study Group to the JTC 1 SWG-SP APSG (TSG-1)

TC Technical Committee - often used in names of both international and national committees, for example ISO/TC97 and IEEE TCOS (Technical Committee on Operating Systems)

TC97 Technical Committee 97 – ISO/TC97 has merged into JTC 1

TCOS IEEE Technical Committee on Operating Systems, the IEEE committee which authorized the standardization work on POSIX under IEEE P1003.

TSG-1 - JTC 1 Technical Study Group #1. The first technical study undertaken since the formation of JTC 1. Formally, ISO/IEC/JTC 1/SWG-SP-APSG. The Application Portability Study Group under the auspices of SWG-SP.

WG Working Group - - As part of a proper noun "WG" refers to a working group within a JTC 1 subcommittee, for example SC22 WG15. IEEE technical committees(ie: P1003) also have working groups, (ie: P10003.5). However X3 technical committees (ie: X3H3) have *task groups* (ie: X3H3.6).

X Window System X was the first server based window system. It was developed jointly by Massachusetts Institute of Technology (MIT) and Digital Equipment Corporation(DEC).

X Consortium The consortium adopting both consensus and de facto standards for the X/OPEN Open Systems Environment.

X/OPEN A marketing organization, labeling products which comply with standards established by the X Consortium.

X3 Accredited National Standards Committee - Information Technology

X3H2 The X3 Committee for Database. TAG to SC21 WG3. Includes all work on SQL

X3H3 The X3 Committee for Graphics, TAG to SC 24.

X3H3.1 - Programmer's Hierarchical Interactive Graphics System (PHIGS)

X3H3.2 - Graphics Architecture: Information Processing Systems - Computer Graphics & Reference Model of Computer Graphics

X3H3.3 - Virtual Device interfaces - Computer Graphics Interface (CGI) & Computer Graphics Metafile (CGM)

X3H3.4 - Language Binding - includes PHIGS/Ada, GKS/Ada, GKS-3D/Ada. X/Ada would be a new work item.

X3H3.5 - Graphical Kernel System (GKS); includes 3 Dimensional extensions to GKS.

X3H3.6 - Window Management; includes Display Management for Graphical Devices

X3H3.7 - Validation, Testing & Registration

X3H3.8 - Application Programming Interface (API) for Imaging Graphical Devices and Data-Stream Encoding for Window Management.

X3H4 The X3 Committee for Information Resource & Dictionary. TAG to SC21 WG3

X3H4.1 - IRDS Reference Model

X3H4.2 - IRDS External Software Interface

X3H4.3 - IRDS Export/Import

X3T2 - The X3 Committee for Data Interchange. TAG to SC21 WG6 and to SC22 WG11. Projects include:

ASN.1 Information Processing - OSI - Specification of Abstract Syntax Notation One (ASN.1)

Common Language-Independent Data Types

Language Independent Procedure Calls

X3T5 - The X3 Committee for Open Systems Interconnection (OSI) TAG to SC 21 WG6

X3T5.1 OSI Architecture TAG to SC21 WG1

X3T5.4 OSI Management Protocols TAG to SC21 WG4

X3T5.5 Application and Presentation Layers TAG to SC21 WG5

X12 Accredited Standards Committee - Electronic Data Interchange